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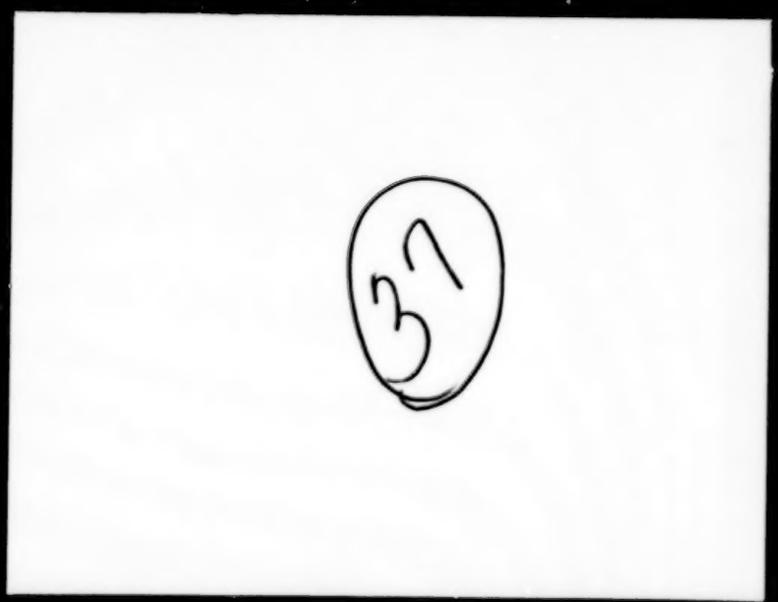
Discussion Paper



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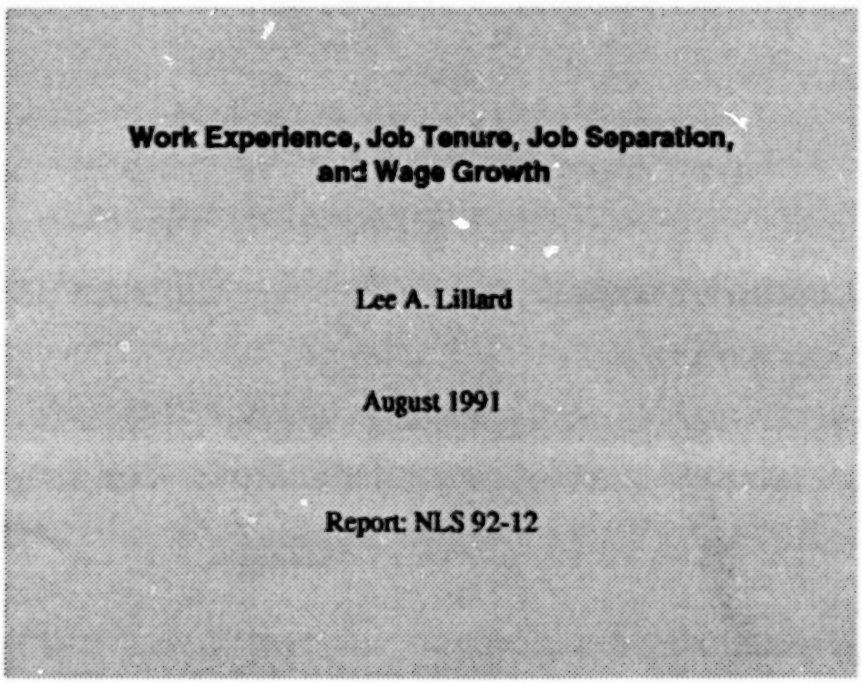
NLS Discussion Papers



Work Experience, Job Tenure, Job Separation, and Wage Growth

Lee A. Lillard
The RAND Corporation

August 1991

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Abstract

- This paper uses the precise dating of job changes and the panel data on wages within jobs in the NLSY to explore their implications for a number of leading theories of job change and wage growth, especially the relationships between general work experience, job tenure, job change, and wages.
- Wages and job change are molded jointly to incorporate the potential endogeneity of job tenure. The estimates indicate a significant effect of job tenure on wages and the hazard of job separation, as well as evidence of returns to job search, job turnover due to match quality, and job specific human capital investments.

Work Experience, Job Tenure, Job Separation and Wage Growth [1]

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This paper uses the precise dating of job changes and the panel data on wages within jobs in the NLSY to explore their implications for a number of leading theories of job change and wage growth, especially the relationships between general work experience, job tenure, job change and wages. Wages and job change are modeled jointly to incorporate the potential endogeneity of job tenure. The estimates indicate a significant effect of job tenure on wages and the hazard of job separation, as well as evidence of returns to job search, job turnover due to match quality, and job specific human capital investments.

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1 Introduction

Study of the determinants of wages has been a mainstay of economics in general and labor economics in particular. More recently there has also been a strong interest in the relationship between wages and tenure with a given employer and in the motives for worker turnover among employers.

A key issue is whether wages rise with tenure with a given employer relative to alternative employers, and then if they do what is the mechanism generating the employer specific premium. The primary theories include (1) returns to investment in employer specific human capital which are shared with the employee (to induce the worker to not leave), (2) implicit contractual arrangements which use wage growth (or 'backloading' of wages) as incentives for effort (against shirking) or to reduce turnover, and (3) revelation of information on the quality of worker-employer match, differences in worker ability, and returns to search.

This study provides a number of new insights into the empirical plausibility and relative importance of these theoretical perspectives by providing an empirical framework to study the relationship between job turnover and wages with a special emphasis on the roles of general work experience and job tenure. It makes use of unique data from the National Longitudinal Survey of Youth (NLSY) on the precise timing of begin and end dates of employment (with each employer), one or more wage observations on each job (importantly including jobs beginning and ending between surveys), and the precise dating of employer provided training on these jobs, and outside vocational training, as well as numerous demographic and job characteristics over a period of up to seven years (1979-86). This data provides a unique opportunity to address issues important to the discrimination among the important theories of wage determination and job turnover.

Use of this detailed information on the wages, jobs, and work experience of young workers requires the development of a richer, more flexible empirical model. This study develops and implements a empirical model of the joint determination of wages, including individual differences in the level and growth of wages, and the hazard of job separation which utilizes the richness of the NLSY data.

First, a discussion of the models of wage determination and of the hazard of job separation are presented in section 2, along with a brief discussion of the estimation procedures. The data on wages and job duration are described in section 3 along with the unique features relevant to this study and the model parameter estimates. Section 4 discussed the results and their implications for theories of job turnover and wage determination.

2 The Model

The essential features of the model are related to the dynamics of wage variation over time as a function of general work experience and job tenure and its relationship to the dynamics of job change.

The following discussion presents first the wage equation and then the hazard of job separation. This is followed by a brief presentation of the likelihood function and estimation method.

2.1 The Wage Equation

The basic wage equation is designed to focus on individual patterns of wage growth with labor market experience and with job tenure. The basic wage equation relates the (log) wage ($W_{ij}(t)$) at time t of individual i on job j to his total months of labor market experience, $Exp_i^*(t)$, and to his tenure on his current $(j-th)$ job, $Ten_{ij}^*(t)$.

$$W_{ij}(t) = A_i + B_i Exp_i^*(t) + C_{ij} + D_{ij} Ten_{ij}^*(t) + U_{ij}(t)$$

Each worker has an individual intercept, A_i, upon entering the labor market at the beginning of his career and an individual rate of growth of wages with general work experience, $B_i Exp_i^*(t)$. The intercept A_i may be a function of the (non-time varying) characteristics of the worker, X_i.

$$A_i = \bar{A} + \gamma_a' X_i + \delta_{ai}$$

This equation relates initial labor market entry wages to covariates X_i, with $\bar{A}$ being mean (log) entry wages.[2]

The model is specified with $\bar{B} = 1$[3] so that the mean experience profile given by the piecewise linear spline equation

$$Exp_i^*(t) = \sum_{k=1}^{n_{exp}} \theta_k^* V_k(\text{experience}_i\ (t))$$

where n_{exp} is the number of nodes and the function V is the usual linear spline operator[4]. The coefficient on $Exp_i^*(t)$, B_i, may be a function of the (non-time varying) characteristics of the worker, X_i.

$$B_i = \bar{B} + \gamma_b' X_i + \delta_{bi}$$

The covariates X_i then proportionally shift the mean profile according to the regression function. The intercept and the experience slope each have random elements, δ_{ai} and δ_{bi} respectively, which may be correlated.

Upon beginning each new job, say the $j-th$, the worker receives an initial wage, C_{ij}, and rate of growth of his wage with job tenure on that job, $D_{ij} Ten_{ij}^*(t)$. Draws of C_{ij} and D_{ij} are assumed independent (iid) from job to job, except that they are functions of the characteristics of the job. That is,

$$\begin{aligned} C_{ij} &= \bar{C} + \gamma_c' Z_{ij} + \delta_{c_{ij}} \\ D_{ij} &= \bar{D} + \gamma_d' Z_{ij} + \delta_{d_{ij}} \end{aligned}$$

The first equation relates initial wages on a job to the characteristics of that specific job Z_{ij}, or the characteristics of the worker on that job.[5] On average C_{ij} must be zero,[6] so that $\bar{C} = 0$.

[2] The covariates X_i are measured as deviation from the mean over individuals.

[3] The covariates X_i are measured as deviation from the mean over individuals. Equivalently, one might allow $\bar{B}$ free while normalizing θ_1, the spline coefficient in the first interval, to one so that subsequent θ's represent "experience-equivalent" units of work experience.

[4] $V_k(x) = max[0, min\ (t - \mu_{k-1}, \mu_k - \mu_{k-1})]$ where $\mu_k (k = 1, n-1)$ are the nodes. Implicitly, μ_0 and $\mu_n = \infty$. This flexible functional form includes the linear experience variable as a special case ($\theta_k = 1$, for all k) and can easily approximate the form of the more usual quadratic terms (without requiring a peak).

[5] The job covariates are measured as deviations from the mean over jobs.

[6] If a worker receives a higher initial wage on average, then the implied $\bar{C}_i$ becomes part of that workers A_i.

The second equation relates the growth in wages with tenure on that job to the characteristics of the job. The model is specified with $\bar{D} = 1$[7] so that the mean tenure profile given by the piecewise linear spline equation $Ten^*_{ij}(t)$, *i.e.*

$$Ten^*_{ij}(t) = \sum_{k=1}^{n_{ten}} \zeta^*_k V_k(\text{tenure}_{ij}(t))$$

where n_{ten} is the number of nodes and the function V is the usual linear spline operator. Again, this flexible functional includes the linear experience and tenure variables as a special case ($\zeta_k = 1$ for all k) and can easily approximate the more usual quadratic tenure terms. The regression equation for the coefficient D_{ij} represents shifts in the profile as a function of the characteristics of the job or of the individual on that job, and a random residual term δ_{di}. The job-person specific residual intercept, (δ_{ci}, and tenure slope, δ_{di}, may be correlated with each other, but must be orthogonal to δ_{ai} and δ_{bi}.

In addition to these experience and tenure components of wages, there is a time series of deviations from these profiles, $U_{ij}(t)$, where

$$U_{ij}(t) = \gamma'_u Y_{ij}(t) + u_{ij}(t).$$

The $Y_{ij}(t)$are measured time varying covariates influencing wages, such as business cycle and local labor market conditions, and $u_{ij}(t)$ is a purely and residual reflecting random variation in wages and measurement error.

The wage equation may be written in terms of covariates and residuals by substituting for A, B, C, D and U.

$$\begin{aligned} W_{ij}(t) &= \bar{A} + \gamma'_a X_i + Exp^*_i(t) + \gamma'_b X_i)\ Exp^*_i(t) \\ &+ \gamma'_c Z_{ij} + Ten_{ij}(t) + \gamma'_d Z_{ij}\ Ten^*_{ij}(t) + \gamma_u Y_{ij}(t) \\ &+ \delta_{a_i} + \delta_{b_i}\ Exp^*(t) + \delta_{c_{ij}} + \delta_{d_{ij}}\ Ten^*(t) + u_{ij}(t) \end{aligned}$$

The covariates X_i are interacted with the fill set of experience spline variables represented in Exp^*, and the job-level covariates Z_i are interacted with the full set of tenure spline variables represented in Ten^*, but in a way which maintains the basic proportionality of the spline coefficients.

The residuals terms indicate individual and job level random coefficients on experience and tenure respectively. They induce both heterogeneity and correlation among residuals over the work career.

2.2 The Hazard of Job Separation

Individuals may hold a number of jobs during their work careers. Once a job begins, say the $j-th$, the worker is immediately at risk to leave the job. The job is assumed to ultimately end at some point, with work experience E_j and job tenure τ_j. The basic equation of job exit behavior is the (log) hazard of leaving the job, say the $j-th$,

$$ln\ g_{ij}(t) = \alpha_0 + Exp^{**}_i(t) + Ten^{**}_{ij}(t) + \alpha'_1 X_i + \alpha'_2 Z_{ij} + \alpha'_3 Y_{ij}(t) + \epsilon_i.$$

[7]Since work experience is the sum of tenure on all jobs, a worker who always, or on average, has greater wage growth with tenure has a steeper experience profile, so that any $\bar{D}_i$ becomes part of B_i.

The log hazard of job separation incorporates two forms of duration dependence – general work experience and current job tenure. Each changes linearly in time within a job, but their effects may be separated because of variation initial work experience at the beginning of the job. The terms $Exp^{**}(t)$ and $Ten^{**}_{ij}(t)$ are each piecewise linear splines in work experience and job tenure.

$$Exp^{**}_{i}(t) = \sum_{k=1}^{m_{exp}} \theta^{**}_{k} V_k(\text{experience}_{i}(t))$$

$$Ten^{**}_{ij}(t) = \sum_{k=1}^{m_{ten}} \zeta^{**}_{k} V_k(\text{tenure}_{ij}(t))$$

where m_{exp} and m_{ten} are the number of nodes in experience and tenure respectively, and the function V is the usual linear spline operator.

The hazard equation is assumed to hold for all jobs and individuals, but is a function of individual characteristics X_i, the characteristics of the job (or the workers characteristics on that job) Z_{ij} and time varying covariates $Y_{ij}(t)$. In addition, the hazard of job separation includes a residual term, ϵ_i, reflecting individual differences (heterogeneity) in the rate of job changes. [8]

The hazard of job separation, conditional on worker heterogeneity ϵ, is given by

$$g_{ij}(t,\epsilon) = e^{\alpha_0 + Exp^{**}_{i}(t) + Ten^{**}_{ij}(t)} e^{\alpha_1' X_i + \alpha_2 Z_{ij} + \alpha_3' Y_{ij}(t) + \epsilon_i}$$

The combination of the effects of Exp^{**} and Ten^{**} may be termed an "overlapping spline" formulation of the hazard. Let the "baseline" hazard be composed of the intercept and the combined duration effects. Then the "baseline" survivor function is

$$G_{oij}(t) = e^{-\int_{t_{oij}}^{t} e^{\alpha_0 + Exp^{**}_{i}(\xi) + Ten^{**}_{ij}(\xi)} d\xi}$$

Covariates cause proportional shifts in the hazard. The covariates X_i and Z_{ij} are constant for the duration of a job. The covariates $Y_{ij}(t)$ may vary over time within a job, but are assumed constant within subintervals of time. Denote the number of such subintervals by I_{ij} and the end points of the subintervals by t_{ijq}. Therefore, the conditional (on ϵ) survivor function for job j is given by [9]

$$G_{ij}(t, \chi(t), \epsilon) = \prod_{q=1}^{I_{ij}} \left[\frac{G_{oij}(t_{ijq+1})}{G_{oij}(t_{ijq})} \right]^{e^{\alpha_1' X_i + \alpha_2' Z_i + \alpha_3' Y_{ij}(t) + \epsilon_i}}$$

where $\chi(t)$ denotes the full history of time varying covariates Y_{ij} up to t. The conditional density function of completed job duration τ_j is given by

$$G^{*}_{ij}(\tau_j, \chi(\tau_j), \epsilon) = g_{ij}(\tau_j, \epsilon) G_{ij}(\tau_j, \chi(\tau_j), \epsilon).$$

These hazard and survivor functions are conditional on individual heterogeneity in the rate of job change, ϵ_i. Individual heterogeneity in the rate of job leaving is identified by the observation

[8] If the rate of job turnover is correlated with the level and rate of growth of wages, then failure to control for the endogeneity of job change will bias estimates of the effect of experience and tenure on wages. The nature of this correlation speaks directly to certain hypotheses to be discussed later.

[9] $= e^{-\int_{t_o}^{t} g_{ij}(t,\epsilon) dt} = e^{-\sum_{q=1}^{I_{ij}} \int_{t_{ijq}}^{t_{ij\,q+1}} g_{ij}(t,\epsilon) dt}$

of the duration of all job held by workers over a fixed length of time.

2.3 Estimation

Parameters of the model are estimated by maximum likelihood based on assumption of joint normality of the three independent sets of stochastic elements $(\epsilon, \delta_a, \delta_b)$, $(\delta_{cj}, \delta_{dj})$, and $u_{ij}(t)$. The first set of three represent heterogeneity in, respectively, the hazard of job separation, the level of initial wages, and the growth of wages with general labor market experience.

$$\begin{pmatrix} \epsilon \\ \delta_a \\ \delta_b \end{pmatrix} \sim N(0, \begin{bmatrix} \sigma_\epsilon^2 & \sigma_\epsilon\sigma_{\delta_a}\rho_{\epsilon\delta_a} & \sigma_\epsilon\sigma_{\delta_b}\rho_{\epsilon\delta_b} \\ \sigma_\epsilon\sigma_{\delta_a}\rho_{\epsilon\delta_a} & \sigma_{\delta_a}^2 & \sigma_{\delta_a}\sigma_{\delta_b}\rho_{\delta_a\delta_b} \\ \sigma_\epsilon\sigma_{\delta_b}\rho_{\epsilon\delta_b} & \sigma_{\delta_a}\sigma_{\delta_b}\rho_{\delta_a\delta_b} & \sigma_{\delta_b}^2 \end{bmatrix}).$$

The second set represent job specific heterogeneity in the initial level of wages and wage growth with tenure on the job, both specific to a job and independent from job to job.

$$\begin{pmatrix} \delta_c \\ \delta_d \end{pmatrix} \sim N(0, \begin{bmatrix} \sigma_{\delta_c}^2 & \sigma_{\delta_c}\sigma_{\delta_d}\rho_{\delta_c\delta_d} \\ \sigma_{\delta_c}\sigma_{\delta_d}\rho_{\delta_c\delta_d} & \sigma_{\delta_d}^2 \end{bmatrix})$$

for every job j.

The third set of residual terms are the individual period wage residuals, $\underline{u}' = (u_1, u_2, \ldots, u_T)$, representing both independent variation in wages and observational error.

$$u_{ij}(t) \sim \ iidN(0, \sigma_u^2).$$

It will be convenient to rewrite the wage equation in a simplified matrix notation. Let $\underline{W}$ be the vector of observed wage values for worker i organized in order of job, and then time within job.

$$\underline{W} = \Xi + \zeta$$

where the mean is given by the regression equation

$$\Xi = \left[1_T \ \underline{Exp}_{Ti}^{\cdot}\right] \begin{pmatrix} \gamma_a' \\ \gamma_b' \end{pmatrix} \underline{X} + [I_J \otimes (1_T, \ \underline{Ten}_{T,ij}^{\cdot})][I_J \otimes \begin{pmatrix} \gamma_c' \\ \gamma_d' \end{pmatrix}]\underline{Z} + I_T \otimes \gamma_u' \underline{Y}$$

the residual is given by

$$\zeta = \left[1_T \ \underline{Exp}_{Ti}^{\cdot}\right] \begin{pmatrix} \delta_a \\ \delta_b \end{pmatrix} + I_J \otimes (1_T, \ \underline{Ten}_{T,ij}^{\cdot}) \begin{pmatrix} \delta_{cj} \\ \delta_{dj} \end{pmatrix} + \underline{u}.$$

and the covariate vectors are given by

$$\begin{aligned} \underline{X}' &= \underline{X}' \\ \underline{Z}' &= (\underline{Z}_1', \underline{Z}_2', \ldots, \underline{Z}_J') \\ \underline{Y}' &= (Y_1', Y_2', \ldots, Y_T') \end{aligned}$$

Following this notation

$$\Sigma_{\zeta\zeta} = \left[1_T \ \underline{Exp}^{\bullet}_{Ti}\right] \Sigma_{\delta_a\delta_b} \left[1_T \ \underline{Exp}^{\bullet}_{Ti}\right]' + I_J \otimes (1_T, \ \underline{Ten}^{\bullet}_{T,ij}) \Sigma_{\delta_c\delta_d} (1_T, \ \underline{Ten}^{\bullet}_{T,ij})' + \sigma_u^2 \ I_T$$

and

$$\Sigma_{\zeta\epsilon} = \left[1_T \ \underline{Exp}^{\bullet}_{Ti}\right] \begin{pmatrix} \sigma_{\delta_a} \ \sigma_\epsilon \ \rho_{\delta_a\epsilon} \\ \sigma_{\delta_b} \ \sigma_\epsilon \ \rho_{\delta_b\epsilon} \end{pmatrix}$$

The likelihood for each individual worker, given his observed history of wages and job changes, is given by

$$\begin{aligned} \mathcal{L}_i \ = \ & (2\pi)^{-\frac{T}{2}} |\Sigma_{\zeta\zeta}|^{-\frac{1}{2}} \ e^{-\frac{1}{2}(W_i - \Xi_i)' \Sigma_{\zeta\zeta}^{-1} (W_i - \Xi_i)} \\ & \int_{-\infty}^{\infty} (2\pi)^{-\frac{1}{2}} (\sigma_{\epsilon|W})^{-1} e^{-\frac{1}{2}(\frac{\epsilon - \mu_{\epsilon|W}}{\sigma_{\epsilon|W}})^2} G_{iJ}(t, \chi(t), \epsilon) \prod_{j=1}^{J-1} g_{ij}(\tau_j, \epsilon) G_{ij}(\tau_j, \chi(\tau_j), \epsilon) d\epsilon \end{aligned}$$

where the conditional mean and variance are

$$\mu_{\epsilon|W} = \Sigma_{\epsilon\zeta} \Sigma_{\zeta\zeta}^{-1} (W - \Xi)$$

$$\sigma^2_{\epsilon|W} = \sigma^2_\epsilon - \Sigma_{\epsilon\zeta} \Sigma_{\zeta\zeta}^{-1} \Sigma_{\zeta\epsilon}$$

3 The Data

Estimation of the parameters of the wage equation and the hazard of job separation is extremely demanding in terms of the data requirements. The NLSY has a few key features which make it especially useful for this study.

This study uses data on job [10] , and training, histories constructed from the National Longitudinal Survey Youth (NLSY) cohort, years 1979-1986, and the companion Employer Supplement. Each survey year, respondents were asked detailed demographic questions, as well as questions about training received, employment status, income and assets and academic status. The companion Employer Supplement gathers detailed information on up to five jobs in each survey year. Included in the questions are start/stop dates for each of the five jobs, industry, occupation, usual hours per week worked and wage rate. Table 1 reports the list of variables (X, Z, and Y) entering the wage and job separation equations, their means and standard deviations, and a brief description.

An important feature of the survey is that it covers the full early work career of a representative set of young men [11] so that there is no problem of unobserved earlier behavior. Our analysis of the wages and job turnover behavior begins when the young men finished formal schooling and entered the labor force, some time during the 1979-1986 period. [12]

Critically important is the reporting of the begin and end dates of all jobs, and the reporting of wages – at survey dates and for all jobs held since the last survey. The Employer Supplement

[10] Throughout the term job is meant to imply employer rather than task or job description.

[11] Women are not included in this study.

[12] Individuals were excluded if we could not determine the respondent's education or if industry was missing for all jobs.

is used to construct begin and end dates for all jobs held during the survey period, 1979-1986. [13] This includes jobs beginning and ending between surveys, which would be missed in the annual reports of wages and jobs. [14] Figure 1 illustrates the basic patterns of data in the context of a job event history.

The resulting sample includes 5,265 young men who held a total of 18,427 jobs and reported a total 28,586 wage values over the seven year period. The distribution of number of jobs held is reported in Table 2. The fraction of these jobs which were censored, *i.e.* still in progress as of the final survey date, mean duration of the completed jobs, and mean full time experience at the beginning of the job are reported in Table 3. The overall distribution of number of wage values available for each job is reported in Table 4. [15] Table 5 reports mean values of the fraction reporting some period of non-work just before the job began, the duration of the period of non-work (for positive values), and the cumulative time in non-work (including the current amount) prior to the job.

4 Results

The model includes a large number of equations and even more relationships to be considered, involving more than a hundred jointly estimared parameters. Maximul likelihood estimates of the parameters are presinted in Table 6, for the basic model. Appendix table 2 presents estimates of the parameters of the model without covariates, representing the basic relationships in the raw wage and job duration data. Appendix Table 3 presents estimates of the basic model enhanced to include measures of the accumulation of, and time lapsed since , vocational training and formal on-th-job training events.

Overall, the results indicate evidence for a number of theories of wage growth and job turnover. All components of wage growth and of the hazard of job turnover are significantly related to explanatory factors in ways that are intuitively appealing. There is also significant and important variation in the components of heterogeneity – in initial career wages and career wage development, in initial job specific wage and the effects of job tenure on wages, in transitory wage variation, and finally in the the hazard of job turnover. Let us take the various components of the model in turn, then relate them to the various theories.

4.1 Initial Wage Levels and the Wage Growth With General Experience

Initial wages are significnatly enhanced at higher levels of of measured IQ. And having a college education very significantly increases initial earnings by approximately 23 percent.

The average pattern of wage growth with general experience is represented in the top portion of Figure 2. After the first year wages rise fairly sharply until year three the taper of a bit thereafter (shown to eight years). Only education increases the rate of growth of wages with general work experience (*i.e.* shifts the slope of the overall curve). Remember that any wage gains occuring on every job are attributed to general work experience, but may be due to greater learning on each job. College graduates both have higher initial wages and greater wage growth. The effects of education are illustrated in Figure 4. Interestingly measured IQ does not increase wage growth, only the initial level, conditional on education level which is another measure of learning ability. This result for IQ is counter to a learning interpretation of general wage growth.

[13] Only those jobs that were in progress when left formal schooling or thereafter.

[14] It is assumed that reported wages are as of the end of the job.

[15] The distribution by job number is reported in the Appendix.

Table 1.
Variable Descriptions, Means, Standard Deviations, and
Specifications of the Wage and Job Separation Equation

Legend: 1 = Wage Function
2 = Hazard of Job Separation - 1-st job

Variable	1	2	Mean,%		Description
FT Exp	x	x			Full time exper - months, begining of job
Job Tenure	x	x			Tenure on current job - months
WORKER CHARACTERISTICS (X)					
Black	x	x	.231		Race indicating black
Ed < 12	x	x	.295		Less than high school education
Ed 13-15	x	x	.192		Some college
Ed 16+	x	x	.120		College graduate
IQBOT25	x	x	.250		IQ measure in bottom 25 percent
IQ2550	x	x	.250		IQ measure in 2-nd quartile
IQTOP25	x	x	.250		IQ measure in top 25 percent
JOB CHARACTERISTICS (Z)					
UNJ	x	x	18.7	.39	Job covered under union agreement
GJ	x	x	3.0	.17	State or federal government supported job
SERV	x	x	22.9	.42	Industry - Services and Retail Trade
CONST	x	x	18.8	.39	Industry - Construction
OTHER	x	x	36.2	.48	Industry - All others (Omitted = Manufacture)
SAMEI	x	x	32.2	.47	Same industry as previous job
J1INP	x	x	8.1	.27	First job in progress before leaving school
BJNWK	x	x	67.0	.47	Indicator of some non-work before current job
BJUNMO	x	x	6.1	11.45	Weeks of non-work before current job
CUMWKNW	x	x	19.9	22.95	Cumulative weeks of non-work before current job
FTEXP0			16.5	20.27	Mos. experience at start of job
LNWAGE			5.2	.52	Log Weekly Wage
TIME VARYING VARIABLES (Y)					
UNT		x	.164	.02	US % LF with positive weeks unemployed
GDP		x	13.01	.06	US Gross domestic product ($Bil)

Table 2.

Distribution of Number of Jobs Held

Jobs	Number	%
1	1277	24.3
2	1082	20.6
3	852	16.2
4	623	11.8
5	432	8.2
6	343	6.5
7	215	4.1
8	156	3.0
9	93	1.8
10	64	1.2
11	46	0.9
12	82	1.6
Total	5265	100.0

Table 3.

Censored and Completed Durations
and Initial Experience by Job Order

Job	Number	Percent Censored	Mean Final Tenure	Mean Initial FTEXP
1	5265	18.3	17.2	0.0
2	3988	21.0	13.5	11.5
3	2906	22.4	12.0	19.1
4	2054	23.3	11.0	24.9
5	1432	22.6	9.9	30.0
6	999	26.3	8.3	35.4
7	656	24.7	7.5	37.6
8	441	26.3	7.3	40.4
9	285	22.1	6.9	42.2
10	192	24.0	6.6	44.9
11	128	28.1	6.6	45.9
12	82	18.3	5.7	47.8
Total	18427	21.5	12.9	16.5

Table 4.

Number of Wage Observations per Job

No.	Freq	%
0	2649	14.3
1	9150	49.6
2	3762	20.4
3	1346	7.3
4	604	3.2
5	432	2.3
6	230	1.2
7	132	0.7
8	122	0.6
Total	18427	100.0

Table 5.

Job Characteristics by Job Number

Job	% BJNW	Weeks BJUNMO	Weeks CUMWKNW	SAMEI
1	60	16.5	16.5	0
2	72	7.6	15.7	44
3	71	6.9	20.7	43
4	68	6.2	24.7	45
5	69	6.2	28.9	47
6	66	5.4	31.9	46
7	66	4.7	34.6	47
8	68	4.2	36.4	47
9	71	4.0	39.3	49
10	64	3.4	40.6	51
11	66	3.2	45.1	53
12	74	4.2	48.9	62
Total	67	9.1	20.0	32

Blacks earn significantly less in initial wages, but the difference is only about 4.5 percent and wage growth with general experience is not significantly less.

4.2 Job Specific Initial Wages and Wage Growth

A number of measured factors significantly affect the initial level of wages on the job. These include industry of employment, being covered by a union contract, government employment, coming from a last job in the same industry, and time spent not working (out of the labor force or unemployed) between jobs or between school and first job.

The average pattern of wage growth with job tenure is uniquely illustrated by the spline function, as shown in the second panel of Figure 2. Wages increase with job tenure only over the forst year on the job, then are a constant differential from initial wages. Therefore, while wages do not continue to rise with tenure for a long period, there is a significant loss of wages, about 7 percent, from leaving a job after one year. The effect of multiple jobs is illustrated in Figure 3. Only time not working significantly affects wage growth on the job.

4.3 Dynamics of Job Separation and Job Duration

The hazard of leaving a job is significantly related to both individual characteristics and the characteristics of the job. These include education, measured IQ, industry, union and government jobs, and local labor market conditions. The hazard of leaving the job declines both with general work experience and with job tenure, as illustrated in Table 3, and for some covariates in the following tables.

4.4 Residual Variation in Wage Growth and the Rate of Job Turnover

There is significant correlation between the hazard of job leaving and wage growth with work experience, but not with initual wage. Thus models of wage growth not accounting for theis correlation will systematically attribute too much wage growth to long jobs.

Table 6.
Structural Parameter Estimates
Wages

	Individual			Job Specific	
	Initial Level	Growth With Experience		Initial Level	Growth With Tenure
Exp* (Months):			Ten* (Months):		
SFELT12		0.0036 ***	STNLT12		0.0051 ***
		(0.0010)			(0.0007)
SFE1224		0.0052 ***	STN1224		0.0007 ***
		(0.0006)			(0.0002)
SFE2436		0.0074 ***	STN24P		-0.0002 **
		(0.0006)			(0.0001)
SFE36P		0.0035 ***	Covariates:		
		(0.0002)	_ONE	0.0000	1.0000
Covariates (X):			UNJ	0.1575 ***	0.1286
Intercept	5.0744 ***	1.0000		(0.0128)	(0.2661)
	(0.0105)		GJ	-0.2108 ***	-0.1252
BLACK	-0.0445 ***	-0.0922		(0.0244)	(0.6234)
	(0.0156)	(0.0812)	SERV	-0.1872 ***	0.0855
EDLT12	0.0016	-0.2399 ***		(0.0177)	(0.3672)
	(0.0155)	(0.0748)	CONS	0.1197 ***	-0.3285
ED1315	0.0000	0.3779 ***		(0.0170)	(0.3716)
	(0.0164)	(0.0825)	OTHR	-0.0817 ***	-0.3432
ED16P	0.2344 ***	0.6554 ***		(0.0157)	(0.3235)
	(0.0205)	(0.1163)	SAMEI	0.0613 ***	-0.3955
IQBOT2	-0.1467 ***	-0.1360		(0.0118)	(0.2579)
	(0.0181)	(0.0861)	J1INP	-0.1303 ***	1.2136 **
IQ2550	-0.0619 ***	-0.0031		(0.0237)	(0.4797)
	(0.0166)	(0.0830)	BJNW	-0.0650 ***	0.1866
IQTOP2	0.0798 ***	0.0241		(0.0130)	(0.2801)
	(0.0160)	(0.0817)	BJUNMO	-0.0016 ***	0.0326 **
				(0.0006)	(0.0129)
			CUMWKNW	-0.0008 ***	-0.0146 **
				(0.0003)	(0.0064)

NOTE: (a) Proportional Shifts In "Baseline" Growth Due to Covariates in Deviations from Means.

Table 6a.
Structural Parameter Estimates
Hazard of Job Separation

Exp** (Months)		Ten** (Months)	
EX-0-12	-0.0217 ***	G-Int	-2.3075 ***
	(0.0033)		(0.0380)
EX-12-36	-0.0091 ***	G0-3	0.1225 ***
	(0.0014)		(0.0148)
EX-36P	-0.0055 ***	G3-6	-0.1966 ***
	(0.0010)		(0.0129)
		G6-12	-0.0086
			(0.0072)
Covariates (X):		G12-24	-0.0216 ***
BLACK	0.0680 **		(0.0047)
	(0.0310)	G24-36	-0.0108 *
			(0.0058)
EDLT12	0.2933 ***	G36P	-0.0059 **
	(0.0303)		(0.0029)
ED1315	0.0425	Covariates (Z):	
	(0.0336)	J1INP	-0.2689 ***
ED16P	-0.5282 ***		(0.0409)
	(0.0541)	BJNW	0.1901 ***
			(0.0238)
IQBOT25	0.0585 *	BJUNMO	-0.0046 ***
	(0.0352)		(0.0010)
IQ2550	0.0523	CUMWKNW	0.0012 *
	(0.0322)		(0.0007)
IQTOP25	-0.0773 **	SERV	0.0862 ***
	(0.0346)		(0.0298)
		CONST	0.3474 ***
			(0.0324)
		OTHER	0.1102 ***
			(0.0276)
		SAMEI	-0.0148
			(0.0214)
		UNJ	-0.6629 ***
			(0.0267)
		GJ	0.2671 ***
			(0.0522)
		Covariates (Y):	
		UNT	-1.4337 ***
			(0.4220)
		GSP	-0.0238 ***
			(0.0092)

Table 6b.

Wage and Job Turnover Residual Variance Components
Standard Deviations and Correlations

	Wage Components					Job Change
	Transit	General		Job Specific		
		Initial Level	Growth w/Exper	Initial Level	Growth w/Tenure	
Wage Components						
Transitory	.2634 (.0007)					
				(Symetric)		
General						
Initial Level		.2645 (.0061)				
Growth w/Exper.		-.4961 (.0338)	.8677 (.0409)			
Job Specific						
Initial Level				.3062 (.0033)		
Growth w/Tenure				-.5421 (.0168)	3.9345 (.5524)	
Job Change		-.0059 (.0381)	-.1490 (.0567)			.4881 (.0174)

Note: Blank entries are zero, except for symmetry of correlations.

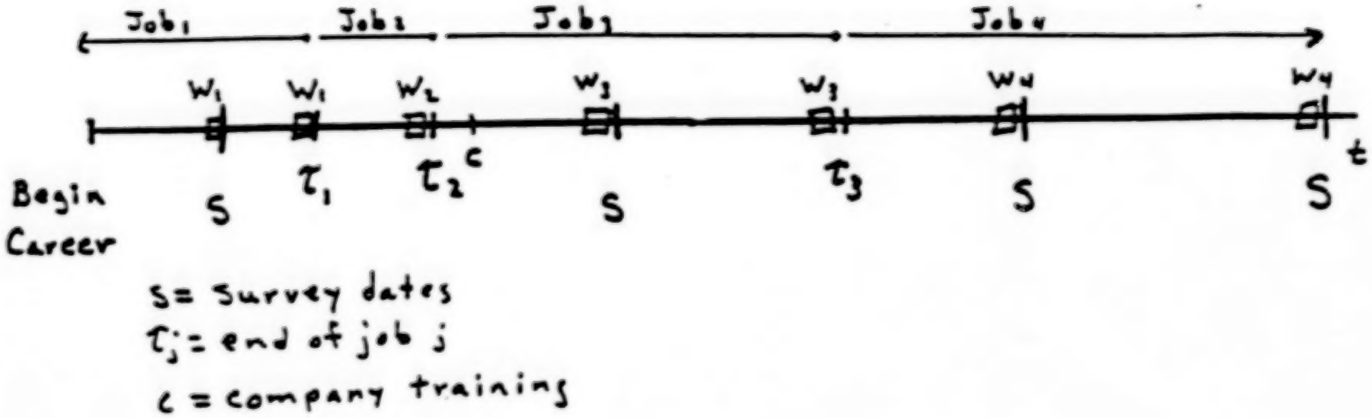

Figure 1: Timing of Wage Observations, Job Separations and Training Events

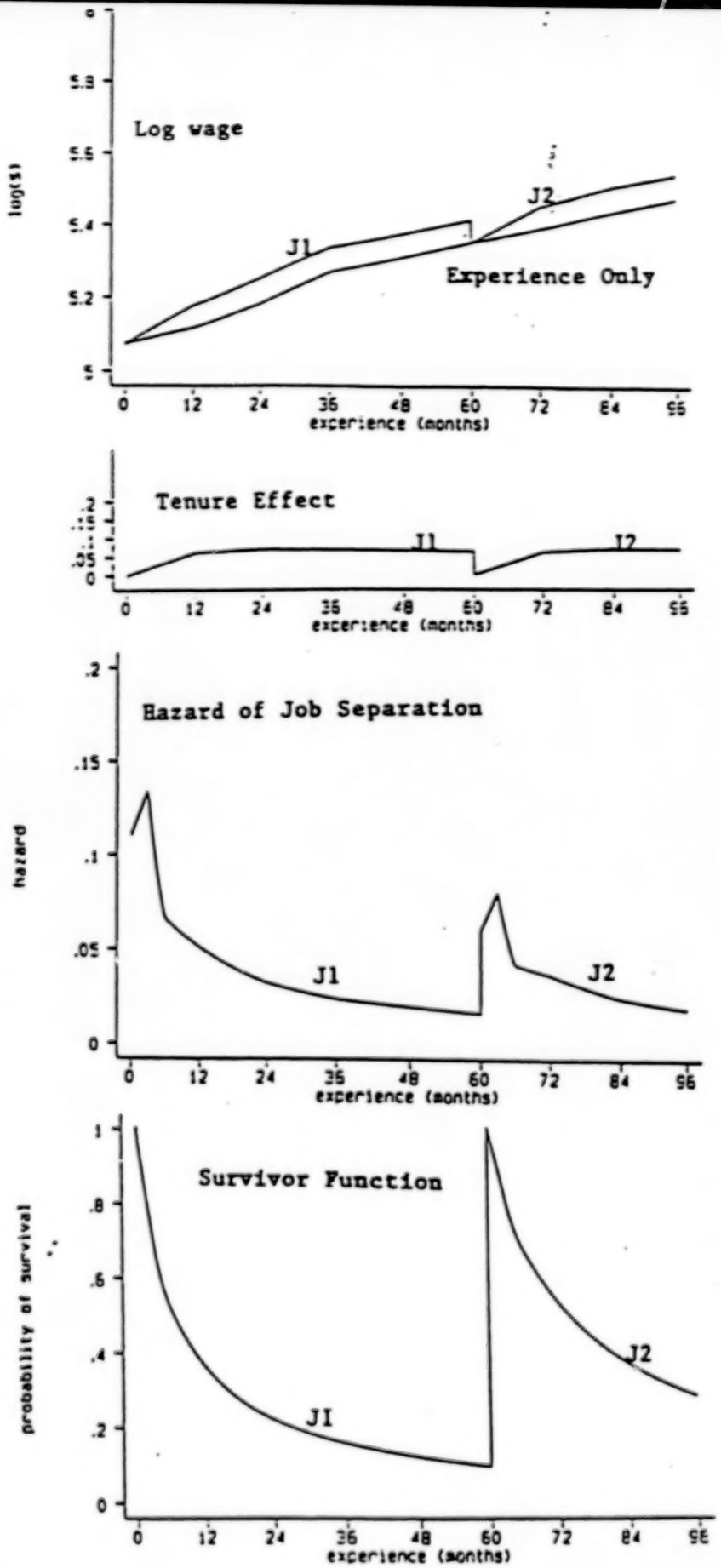

Figure 2: Wages, Hazard of Job Separation, and Employment Survival Function at mean covariates: Two jobs beginning (1) at career entry and (2) after 5 years on the first job.

J1 = Job 1
J2 = Job 2

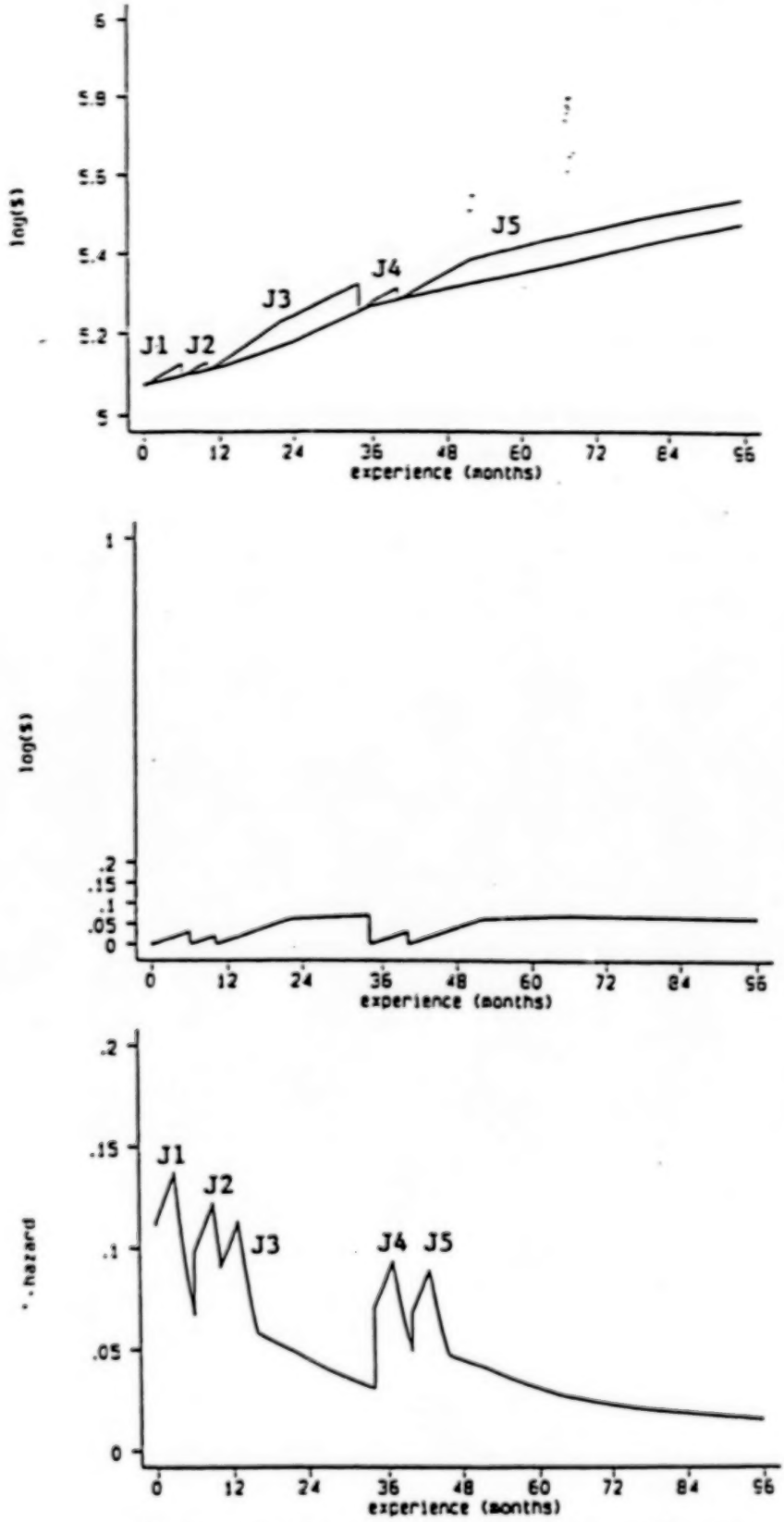

Figure 3: Wages, Hazard of Job Separation, and Employment Survival Function at mean covariates: 5 jobs beginning

(1) J1 at career entry
(2) J2 at 6 months experience
(3) J3 at 10 months experience
(4) J4 at 34 months experience
(5) J5 at 46 months experience

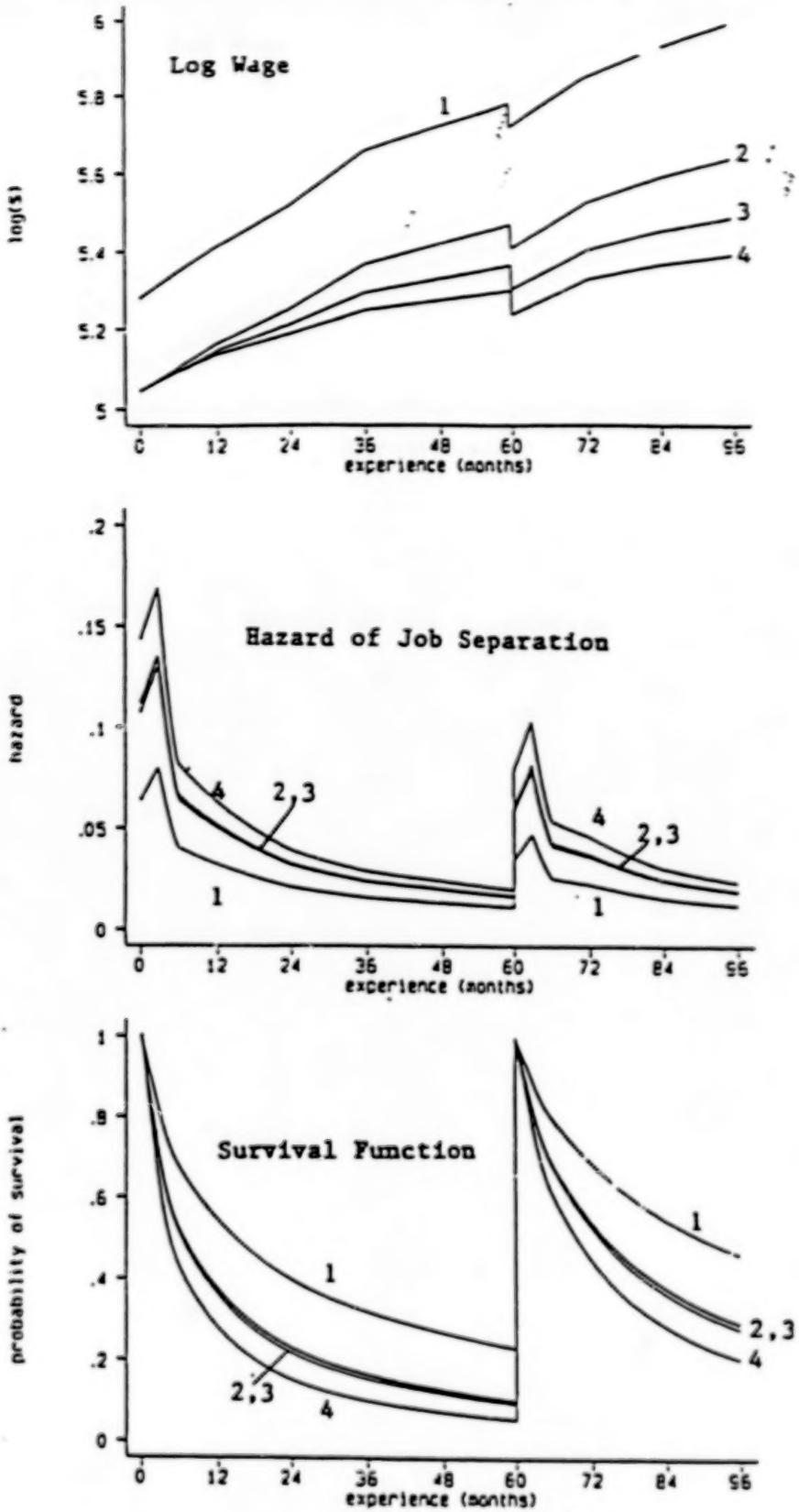

Figure 4: Wages, Hazard of Job Separation and Employment Survival Function, by education, at mean other covariates

1 = college
2 = some college
3 = high school
4 = high school drop out

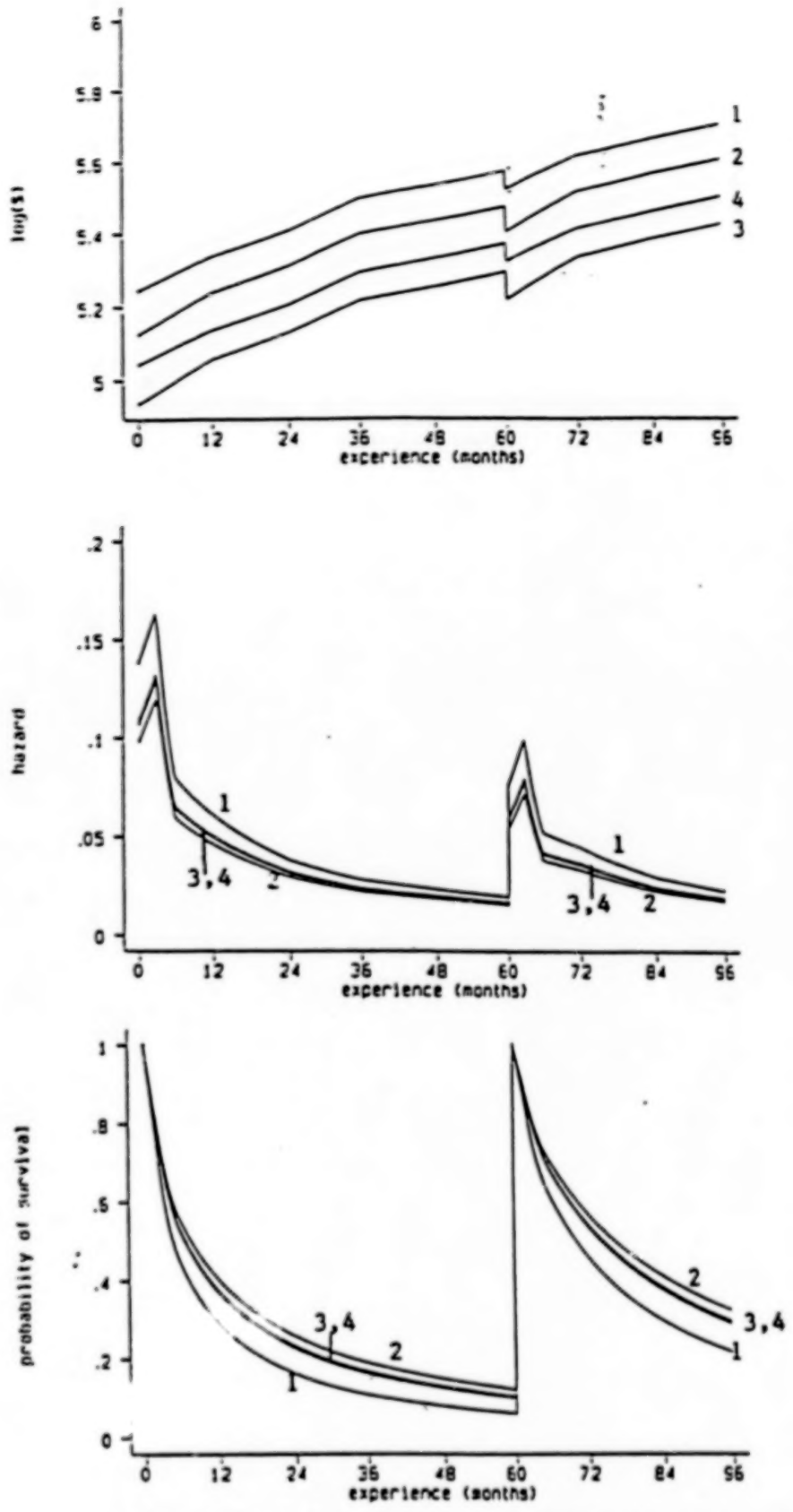

Figure 5: Wages, Hazard of Job Separation and Employment Survival Function, by industruy, 2 jobs each in the same industry

(1) construction
(2) manufacturing
(3) services, retail
(4) other

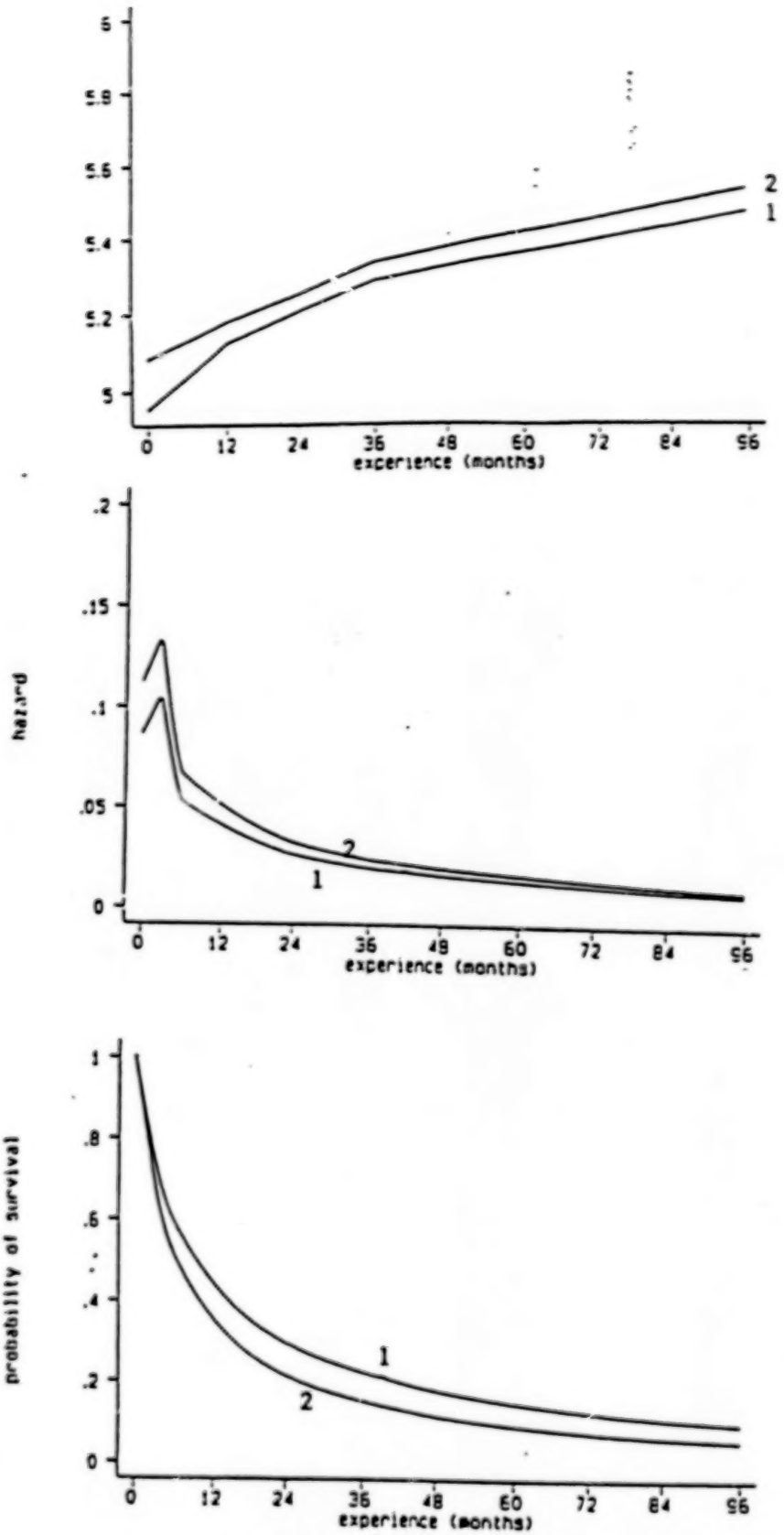

Figure 6: Wages, Hazard of Job Separation and Employment Survival Function:

(1) First job in progress when left school
(2) First job not in progress when left school

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Appendix Table 1.
Number of Wage Observations by Job Number

	First		Second		Third		Fourth		Fifth		Sixth	
#	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
0	629	11.9	587	14.7	448	15.4	309	15.0	229	16.0	161	16.1
1	2531	48.1	1750	43.9	1417	48.8	1006	49.0	753	52.6	577	57.8
2	1023	19.4	909	22.8	605	20.8	459	22.3	284	19.8	190	19.0
3	422	8.0	333	8.4	213	7.3	157	7.6	101	7.1	56	5.6
4	223	4.2	161	4.0	100	3.4	62	3.0	33	2.3	5	0.5
5	168	3.2	117	2.9	69	2.4	39	1.9	26	1.8	7	0.7
6	108	2.1	65	1.6	34	1.2	19	0.9	3	0.2	1	0.1
7	74	1.4	38	1.0	14	0.5	2	0.1	2	0.1	2	0.2
8	87	1.7	28	0.7	6	0.2	1	0.0				

	Seventh		Eighth		Nineth		Tenth		Eleventh		Twelfth	
#	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
0	101	15.4	72	16.3	43	15.1	28	14.6	23	18.0	19	23.2
1	405	61.7	265	60.1	187	65.6	132	68.7	78	60.9	49	59.8
2	112	17.1	78	17.7	40	14.0	27	14.1	24	18.8	11	13.4
3	27	4.1	18	4.1	10	3.5	4	2.1	3	2.3	2	2.4
4	9	1.4	6	1.4	3	1.1	1	0.5			1	1.2
5	2	0.3	2	0.5	2	0.7						

Appendix Table 2.

Wage and Job Change Duration Dependence. Without Regressors

Mean	5.0317 ***
Initial Wage	(0.0103)
Duration Splines:	
Wage Growth with Experience	
SFELT12	0.0082 ***
	(0.0009)
SFE1224	0.0055 ***
	(0.0007)
SFE2436	0.0071 ***
	(0.0006)
SFE36P	0.0032 ***
	(0.0002)
Wage Growth with Tenure:	
STNLT12	0.0043 ***
	(0.0007)
STN1224	0.0007 ***
	(0.0002)
STN24P	0.0000
	(0.0001)
Hazard of Job Separation	
Full Time Work Experience (Months)	
EX-0-12	-0.0149 ***
	(0.0031)
EX-12-36	-0.0071 ***
	(0.0013)
EX-36P	-0.0028 ***
	(0.0010)
Job Tenure (Months)	
G-Int	-2.3771 ***
	(0.0346)
G0-3	0.1072 ***
	(0.0144)
G3-6	-0.2047 ***
	(0.0127)
G6-12	-0.0146 **
	(0.0072)
G12-24	-0.0262 ***
	(0.0047)
G24-36	-0.0126 **
	(0.0058)
G36P	-0.0088 ***
	(0.0029)

Appendix Table 2a.

Wage and Job Turnover Residual Variance Components
Standard Deviations and Correlations

	Wage Components					Job Change
	Transit	General		Job Specific		
		Initial Level	Growth w/Exper	Initial Level	Growth w/Tenure	
Wage Components						
Transitory	.2644 (.0007)					
General						
Initial Level		.3351 (.0188)				
Growth w/Exper.		-.4454 (.0288)	.9082 (.0420)			
Job Specific						
Initial Level				.3154 (.0034)		
Growth w/Tenure				-.4748 (.0305)	4.2469 (.6956)	
Job Turnover		-.1839 (.0323)	-.1625 (.0468)			.6295 (.0173)

Appendix Table 3.
Structural Parameter Estimates
Wages
General Work Experience

	Initial Level	Growth With Experience
Exp* (Months):		
SFELT12		0.0041 ***
		(0.0010)
SFE1224		0.0051 ***
		(0.0006)
SFE2436		0.0074 ***
		(0.0006)
SFE36P		0.0034 ***
		(0.0002)
Covariates:		
Intercept	5.0723 ***	1.0000
	(0.0107)	
BLACK	-0.0461 ***	-0.0915
	(0.0159)	(0.0820)
EDLT12	0.0014	-0.2457 ***
	(0.0158)	(0.0758)
ED1315	-0.0007	0.3654 ***
	(0.0166)	(0.0832)
ED16P	0.2279 ***	0.6591 ***
	(0.0209)	(0.1177)
IQBOT2	-0.1465 ***	-0.1140
	(0.0184)	(0.0873)
IQ2550	-0.0651 ***	0.0320
	(0.0169)	(0.0840)
IQTOP2	0.0819 ***	0.0099
	(0.0163)	(0.0828)

NOTE: (a) Proportional Shifts In "Baseline" Growth Due to Covariates in Deviations from Means.

Appendix Table 3a.
Structural Parameter Estimates
Wages
Job Specific Wages

	Initial Level	Growth With Tenure
Ten* (Months):		
STNLT12		0.0050 ***
		(0.0008)
STN1224		0.0006 ***
		(0.0002)
STN24P		-0.0002 *
		(0.0001)
Covariates:		
_ONE	0.0000	1.0000
UNJ	0.1612 ***	0.0810
	(0.0130)	(0.2801)
GJ	-0.2089 ***	-0.1737
	(0.0248)	(0.6571)
SERV	-0.1804 ***	-0.0760
	(0.0179)	(0.3866)
CONS	0.1292 ***	-0.5499
	(0.0173)	(0.3955)
OTHR	-0.0724 ***	-0.5857 *
	(0.0159)	(0.3451)
SAMEI	0.0607 ***	-0.3869
	(0.0119)	(0.2713)
J1INP	-0.1304 ***	1.2968 **
	(0.0242)	(0.5157)
BJNW	-0.0678 ***	0.2323
	(0.0132)	(0.2967)
BJUNMO	-0.0015 **	0.0323 **
	(0.0006)	(0.0135)
CUMWKNW	-0.0008 ***	-0.0145 **
	(0.0003)	(0.0067)

NOTE: (a) Proportional Shifts In "Baseline" Growth Due to Covariates as Deviations from Means.

Appendix Table 3b.
Structrual Parameter Estimates
Wages
Training Effects

Covariates:	
Company Training:	
COWV	0.0881 ***
	(0.0192)
DS1CO	-0.0000
DS2CO	0.0000
DS3CO	0.0000
S1PJCO	0.0000
S2PJCO	0.0000
S3PJCO	0.0000
TOTVO	0.0100
	(0.0108)
PJDS1VO	0.0000
PJDS2VO	0.0000
PJDS3VO	0.0000

Appendix Table 3c.
Structural Parameter Estimates
Hazard of Job Separation

Exp** (Months)		Ten** (Months)			
EX-0-12	-0.0210 ***	G-Int	-2.3182 ***	Covariates (Y):	
	(0.0033)		(0.0385)	UNT	-1.3758 ***
EX-12-36	-0.0100 ***	G0-3	0.1256 ***		(0.4238)
	(0.0014)		(0.0148)	GSP	-0.0222 **
EX-36P	-0.0059 ***	G3-6	-0.1962 ***		(0.0093)
	(0.0010)		(0.0129)	FTCCO	-1.1238 ***
Covariates: (X)		G6-12	-0.0079		(0.1316)
BLACK	0.0639 **		(0.0073)	DS1CO	0.1445 ***
	(0.0313)	G12-24	-0.0230 ***		(0.0180)
EDLT12	0.2907 ***		(0.0047)	DS2CO	-0.0523 **
	(0.0307)	G24-36	-0.0103 *		(0.0222)
ED1315	0.0390		(0.0058)	DS3CO	0.0200 *
	(0.0340)	G36P	-0.0065 **		(0.0107)
ED16P	-0.5252 ***		(0.0029)	PJCCO	-0.8772 ***
	(0.0544)	Covariates (Z):			(0.3045)
IQBOT25	0.0515	J1INP	-0.2746 ***	S1PJCO	0.0506 **
	(0.0355)		(0.0411)		(0.0201)
IQ2550	0.0549 *	BJNW	0.1965 ***	S2PJCO	0.0008
	(0.0325)		(0.0238)		(0.0059)
IQTOP25	-0.0740 **	BJUNMO	-0.0048 ***	S3PJCO	0.0077
	(0.0349)		(0.0010)		(0.0107)
		CUMWKNW	0.0012 *	TOTVO	-0.4746 ***
			(0.0007)		(0.0712)
		SERV	0.0927 ***	PJDS1VO	0.0393 ***
			(0.0300)		(0.0062)
		CONST	0.3540 ***	PJDS2VO	-0.0127 **
			(0.0328)		(0.0057)
		OTHER	0.1145 ***		
			(0.0277)		
		SAMEI	-0.0133		
			(0.0214)		
		UNJ	-0.6628 ***		
			(0.0269)		
		GJ	0.2809 ***		
			(0.0521)		

Appendix Table 3d.

Wage and Job Turnover Residual Variance Components
Standard Deviations and Correlations

	Wage Components					Job Change
	Transit	General		Job Specific		
		Initial Level	Growth w/Exper	Initial Level	Growth w/Tenure	
Wage Components						
Transitory	.2632 (.0007)					
				(Symetric)		
General						
Initial Level		.2662 (.0062)				
Growth w/Exper.		-.4994 (.0338)	.8763 (.0423)			
Job Specific						
Initial Level				.3070 (.0034)		
Growth w/Tenure				-.5488 (.0165)	4.1908 (.6223)	
Job Turnover		-.0066 (.0385)	-.1476 (.0566)			.4922 (.0178)

Note: Blank entries are zero, except for symmetry of correlations.

END

05/31/95